

## WHAT IS CLAIMED IS:

1. A method for cutting a rare earth alloy using a wire with abrasive grains fixed to a core wire, comprising the step of:

cutting the rare earth alloy with the wire traveling in a state that a portion of the rare earth alloy to be cut with the wire is immersed in a coolant containing water as the main component, the coolant having a surface tension at 25°C in a range of 25 mN/m to 60 mN/m.

2. The method according to claim 1, wherein the coolant contains a water-soluble synthetic lubricant and water in a weight 10 times to 50 times as large as the weight of the synthetic lubricant.

3. The method according to claim 1, wherein the coolant contains a surfactant and water in a weight 10 times to 50 times as large as the weight of the surfactant.

4. The method according to claim 1, wherein the coolant contains an anti-foaming agent.

5. The method according to claim 1, wherein the coolant has a pH of 8 to 11.

6. The method according to claim 1, wherein the coolant contains an anti-corrosive.

7. The method according to claim 1, wherein the abrasive grains are fixed

via a resin layer formed on the outer circumference of the core wire.

8. The method according to claim 1, wherein the average distance between the adjacent abrasive grains in a direction of travel of the wire is in a range of 150% to 600% of the average particle size of the abrasive grains, and the average height of portions of the abrasive grains protruding from the surface of the resin layer is in the range of 10  $\mu$  m to 40  $\mu$  m.

9. The method according to claim 1, wherein the average particle size D of the abrasive grains satisfies the relationship  $20 \mu \text{ m} \leq D \leq 60 \mu \text{ m}$ .

10. The method according to claim 1, wherein in the step of cutting, the portion of the rare earth alloy to be cut with the wire is immersed in the coolant contained in a reservoir, and the coolant is supplied into the reservoir from the bottom of the reservoir and also from an opening of the reservoir, so that the coolant is kept overflowing from the opening.

11. The method according to claim 10, wherein in the step of cutting, the amount of overflow of the coolant per minute is 50% or more of the volume of the reservoir.

12. The method according to claim 10, wherein in the step of cutting, the amount of the coolant supplied from the opening is greater than the amount of the coolant supplied from the bottom.

13. The method according to claim 10, wherein in the step of cutting, curtain-

like flows of a gas or the coolant are formed above the sides of the opening of the reservoir crossing the wire travel direction, so that the coolant is suppressed from overflowing from the opening of the reservoir.

14. The method according to claim 1, wherein the wire is driven by a roller, the roller includes a polymer layer having a guide groove formed therein, the guide groove has a pair of slopes at least one of which has an angle of 50 degrees or more with respect to the surface of the roller, and the wire travels along a space between the pair of slopes.

15. The method according to claim 1, wherein the rare earth alloy is a R-Fe-B rare earth sintered alloy.

16. The method according to claim 15, wherein the rare earth alloy is a Nd-Fe-B rare earth sintered alloy.

17. A method for cutting a rare earth alloy using a wire with abrasive grains fixed to a core wire, comprising the steps of:

allowing the wire wound around a reel bobbin to travel between a plurality of rollers;

supplying a first coolant containing water as the main component to portions of the wire wound around the reel bobbin or portions of the wire traveling near the reel bobbin; and

cutting the rare earth alloy with the traveling wire while a second coolant containing water as the main component is supplied to a portion of the rare

earth alloy to be cut with the wire.

18. The method according to claim 17, wherein the first coolant has a coefficient of dynamic friction against the rare earth alloy at 25°C of 0.3 or less.

19. The method according to claim 17, wherein the second coolant has a coefficient of dynamic friction against the rare earth alloy at 25°C in a range of 0.1 to 0.3.

20. The method according to claim 17, wherein the first coolant is supplied to the wire by spraying.

21. The method according to claim 17, wherein the abrasive grains are fixed via a resin layer formed on the outer circumference of the core wire.

22. The method according to claim 21, wherein the resin is a phenol resin, an epoxy resin, or a polyimide resin.

23. The method according to claim 21, wherein the average distance between the adjacent abrasive grains in a direction of travel of the wire is in a range of 150% to 600% of the average particle size of the abrasive grains, and the average height of portions of the abrasive grains protruding from the surface of the resin layer is in a range of 10  $\mu$  m to 40  $\mu$  m.

24. The method according to claim 17, wherein the first coolant is higher in viscosity than the second coolant.

25. The method according to claim 17, wherein the first coolant and the second coolant have a temperature in a range of 15°C to 35°C.

26. The method according to claim 17, wherein each of the plurality of rollers includes a polymer layer having a guide groove formed therein, the guide groove has a pair of slopes at least one of which has an angle of 50 degrees or more with respect to the surface of the roller, and the wire travels along a space between the pair of slopes.

27. The method according to claim 17, wherein the rare earth alloy is a R-Fe-B rare earth sintered alloy.

28. The method according to claim 27, wherein the rare earth alloy is a Nd-Fe-B rare earth sintered alloy.

29. A method for manufacturing a rare earth magnet comprising the steps of:  
producing a rare earth magnet sintered body from rare earth alloy powder; and

dividing the sintered body into a plurality of rare earth magnets,

wherein the step of dividing the sintered body is executed by a method for cutting a rare earth magnet sintered body using a wire with abrasive grains fixed to a core wire, comprising the step of:

cutting the rare earth magnet sintered body with the wire traveling in a state that a portion of the rare earth alloy sintered body to be cut with the wire is immersed in a coolant containing water as the main component, the coolant

having a surface tension at 25°C in a range of 25 mN/m to 60 mN/m.

30. A method for manufacturing a rare earth magnet comprising the steps of:  
producing a rare earth magnet sintered body from rare earth alloy powder; and

dividing the sintered body into a plurality of rare earth magnets,

wherein the step of dividing the sintered body is executed by a method for cutting a rare earth magnet sintered body using a wire with abrasive grains fixed to a core wire, comprising the steps of:

allowing the wire wound around a reel bobbin to travel between a plurality of rollers;

supplying a first coolant containing water as the main component to portions of the wire wound around the reel bobbin or portions of the wire traveling near the reel bobbin; and

cutting the rare earth magnet sintered body with the traveling wire while a second coolant containing water as the main component is supplied to a portion of the rare earth magnet sintered body to be cut with the wire.

31. A wire-saw machine comprising:

a wire with abrasive grains fixed to a core wire;

a reel bobbin around which the wire is wound;

a plurality of rollers for unwinding the wire wound around the reel bobbin to allow the wire to travel;

a device for supplying a first coolant to a portion of a cut object to be cut

with the wire; and

a device for supplying a second coolant to portions of the wire wound around the reel bobbin or portions of the wire traveling near the reel bobbin.

32. The wire-saw machine according to claim 31, wherein the device for supplying the second coolant comprises a sprayer.

33. The wire-saw machine according to claim 31, wherein each of the plurality of rollers includes a polymer layer having a guide groove formed therein, the guide groove has a pair of slopes at least one of which has an angle of 50 degrees or more with respect to the surface of the roller, and the wire travels along a space between the pair of slopes.

34. A wire-saw machine comprising:

a wire with abrasive grains fixed to a core wire;

a reel bobbin around which the wire is wound;

a plurality of rollers for unwinding the wire wound around the reel bobbin to allow the wire to travel; and

a device for supplying a coolant to a portion of a cut object to be cut with the wire,

wherein each of the plurality of rollers includes a polymer layer having a guide groove formed therein, the guide groove has a pair of slopes at least one of which has an angle of 50 degrees or more with respect to the surface of the roller, and the wire travels along a space between the pair of slopes.

35. The wire-saw machine according to claim 34, wherein the tension of the wire traveling between the plurality of rollers is in a range between 25 N and 35 N.

36. A voice coil motor comprising a rare earth magnet, manufactured by a method for manufacturing a rare earth magnet comprising the steps of:

producing a rare earth magnet sintered body from rare earth alloy powder; and

dividing the sintered body into a plurality of rare earth magnets,

wherein the step of dividing the sintered body is executed by a method for cutting a rare earth magnet sintered body using a wire with abrasive grains fixed to a core wire, comprising the step of:

cutting the rare earth magnet sintered body with the wire traveling in a state that a portion of the rare earth alloy sintered body to be cut with the wire is immersed in a coolant containing water as the main component, the coolant having a surface tension at 25°C in a range of 25 mN/m to 60 mN/m.

37. A voice coil motor comprising a rare earth magnet, manufactured by a method for manufacturing a rare earth magnet comprising the steps of:

producing a rare earth magnet sintered body from rare earth alloy powder; and

dividing the sintered body into a plurality of rare earth magnets,

wherein the step of dividing the sintered body is executed by a method for cutting a rare earth magnet sintered body using a wire with abrasive grains



fixed to a core wire, comprising the step of:

allowing the wire wound around a reel bobbin to travel between a plurality of rollers;

supplying a first coolant containing water as the main component to portions of the wire wound around the reel bobbin or portions of the wire traveling near the reel bobbin; and

cutting the rare earth magnet sintered body with the traveling wire while a second coolant containing water as the main component is supplied to a portion of the rare earth magnet sintered body to be cut with the wire.